

# PLASTICIZERS DERIVED FROM VEGETABLE OILS

## CLAIMS

We claim:

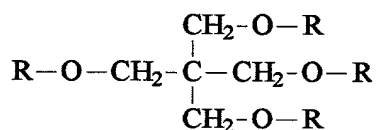
- 1 (1) A plasticized vinyl chloride composition, comprising:
  - 2 (a) about 100 parts by weight of at least one vinyl chloride resin;
  - 3 (b) about 10 to 230 parts by weight of a plasticizer compounded with  
4 said at least one vinyl chloride resin, wherein said plasticizer  
5 comprises a fatty acid product derived from a vegetable oil having  
6 at least 80% by weight of unsaturated fatty acids, wherein said  
7 fatty acids are substantially fully esterified with a monool or a  
8 polyol, and said esterified unsaturated fatty acids have been  
9 substantially fully epoxidized;
  - 10 (c) said vegetable oil derived plasticizers composition comprising,
    - 11 (1) said fatty acid product derived from direct esterification of fatty  
12 acids of said vegetable oil with a monool or a polyol;
    - 13 (2) said fatty acid product derived from transesterification of said  
14 vegetable oil with monools or polyols;
    - 15 (3) said fatty acid product derived from said vegetable oil  
16 interesterified with another vegetable oil having a higher degree of  
17 unsaturation; mixtures of the above; or
    - 18 (4) said fatty acid product derived from a fatty acids from said  
19 vegetable oil esterified with a monool and interesterified with a  
20 polysaccharide carboxylic acid ester. .
- 1 (2) The composition of claim 1, wherein said plasticized vinyl chloride  
1 composition is essentially free of DOP.  
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1 (3) The composition of claim 1, wherein when said alcohol is a polyol and  
2 said fatty acids derived from said vegetable oil are substantially  
3 randomly positioned on the hydroxyl sites of said polyol.

1 (4) The composition of claim 1, wherein said vegetable oil is selected from  
2 the group consisting of,  
3 canola oil (I.V. value about 100-115),  
4 corn oil (I.V. value about 118-128),  
5 linseed oil (IV. value about 170-200),  
6 rapeseed oil (I.V. value about 100-115),  
7 safflower oil (I.V. value about 140-150),  
8 soybean oil (I.V. value about 120-143),  
9 sunflower oil (I.V. value about 125-140),  
10 tall oil (I.V. value about 140-190), and  
11 tung oil (I.V. value about 180) (and mixtures of derivatives thereof) and  
12 mixtures thereof.

1 (5) The composition of claim 1, wherein said plasticizer composition is  
2 derived from a vegetable oil having an iodine value above about 100.

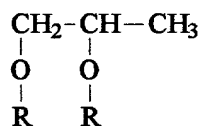
1 (6) The composition of claim 1, wherein said plasticizer composition is  
2 epoxidized pentaerythritol tetrasoyate having the formula:



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8 wherein R (each of the R's may be the same or different) is randomly  
9 selected from the group consisting of:

- 10 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or  
11 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,  
12 and margaroyl.

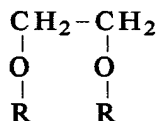
- 1 (7) The composition of claim 1, wherein said composition is epoxidized  
2 propylene glycol disoyate having the formula:



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4 wherein R (each of the R's may be the same or different) is randomly  
5 selected from the group consisting of:

- 6 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or  
7 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,  
8 and margaroyl.

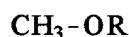
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1 (8) The composition of claim 1, wherein said composition is epoxidized  
2 ethylene glycol disoyate having the formula:



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7 wherein R (each of the R's may be the same or different) is randomly  
8 selected from the group consisting of:

- 9 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or  
10 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,  
11 and margaroyl.

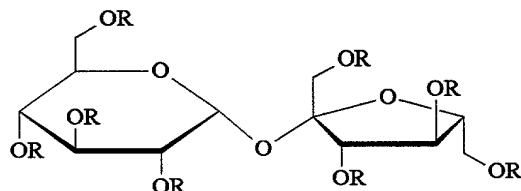
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1 (9) The composition of claim 1, wherein said plasticizer composition is a  
2 mixture of epoxidized methyl soyate having the formula:



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5 wherein R is randomly selected from the group consisting of:

- 6 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or  
7 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,  
8 and margaroyl.

(10) The composition of claim 1, wherein said composition is epoxidized sucrose octasoyate having the formula:

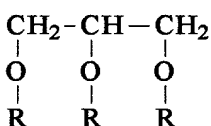


wherein R (each of the R's may be the same or different) is selected from the group consisting of:

- (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
- (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl, and margaroyl.

(11) The composition of claim 1, wherein each R is randomly selected from said group.

(12) The composition of claim 1, wherein said composition is the epoxidized product of a first vegetable oil interesterified with a second vegetable oil, and having the formula:



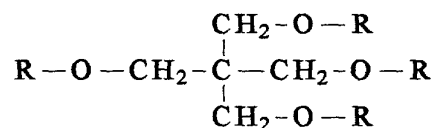
wherein R (each of the R's may be the same or different) is randomly selected from the group consisting of:

- (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
- (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl, and margaroyl.

(13) The composition according to Claim 12, wherein said first vegetable oil has an iodine value greater than 100 and the second vegetable oil has an iodine value greater than the first vegetable oil.

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1 (14) The composition of claim 12, wherein said first vegetable oil is soybean  
2 oil, and said second vegetable oil is linseed oil.

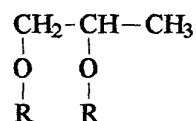
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1 (15) Epoxidized pentaerythritol tetrasoyate having the formula:



7 wherein R (each of the R's may be the same or different) is randomly  
8 selected from the group consisting of:

- 9 (i) substantially fully epoxidized unsaturated fatty acids derived from a  
10 vegetable oil; or  
11 (ii) non-epoxidized saturated fatty acids derived from a vegetable oil;  
12 wherein said vegetable oil has greater than about 80% unsaturated fatty  
13 acids and/or an iodine number above about 100.

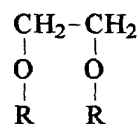
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1 (16) Epoxidized propylene glycol disoyate having the formula:



7 wherein R (each of the R's may be the same or different) is randomly  
8 selected from the group consisting of:

- 9 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or  
10 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,  
11 and margaroyl.

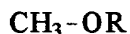
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1 (17) Epoxidized ethylene glycol disoyate having the formula:



wherein R (each of the R's may be the same or different) is randomly selected from the group consisting of

- (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
- (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl, and margaroyl.

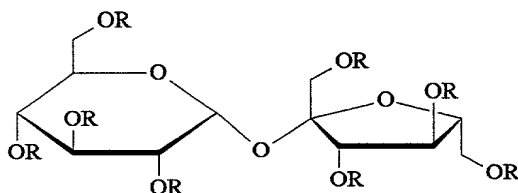
(18) Epoxidized methyl soyate having the formula:



wherein R is randomly selected from the group consisting of:

- (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
- (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl, and margaroyl.

(19) Epoxidized sucrose octasoyate having the formula:

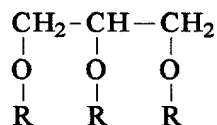


wherein R (each of the R's may be the same or different) is selected from the group consisting of:

- (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
- (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl, and margaroyl.

(20) The composition of claim 1, wherein each R is randomly selected from said group.

(21) The epoxidized product of a first vegetable oil interesterified with a second vegetable oil having the formula:



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8 wherein R (each of the R's may be the same or different) is randomly  
9 selected from the group consisting of:

- 10 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or  
11 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,  
12 and margaroyl.

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1 (22) The composition of claim 21, wherein said first vegetable oil is soybean  
2 oil, and said second vegetable oil is linseed oil.

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1 (23) A plasticized vinyl chloride composition, comprising:

- 2 (a) about 100 parts by weight of at least one vinyl chloride resin;  
3 (b) about 10 to 100 parts by weight of a plasticizer compounded with  
4 said at least one vinyl chloride resin, wherein said plasticizer is  
5 epoxidized pentaerythritol tetrasoyate; and  
6 (c) about 1-3 parts thermal stabilizer compounded with said at least  
7 one vinyl chloride resin and said plasticizer.

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1 (24) A plasticized vinyl chloride composition, comprising:

- 2 (a) about 100 parts by weight of at least one vinyl chloride resin;  
3 (b) about 10 to 100 parts by weight of a plasticizer compounded with  
4 said at least one vinyl chloride resin, wherein said plasticizer is  
5 epoxidized propylene glycol disoyate; and  
6 (c) about 1-3 parts thermal stabilizer compounded with said at least  
7 one vinyl chloride resin and said plasticizer.

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- 1 (25) A plasticized vinyl chloride composition, comprising:  
2 (a) about 100 parts by weight of at least one vinyl chloride resin;  
3 (b) about 10 to 100 parts by weight of a plasticizer compounded with  
4 said at least one vinyl chloride resin, wherein said plasticizer is  
5 epoxidized ethylene glycol disoyate; and  
6 (c) about 1-3 parts thermal stabilizer compounded with said at least  
7 one vinyl chloride resin and said plasticizer.

- 1 (26) A plasticized vinyl chloride composition, comprising:  
2 (a) about 100 parts by weight of at least one vinyl chloride resin;  
3 (b) about 10 to 100 parts by weight of a plasticizer compounded with  
4 said at least one vinyl chloride resin, wherein said plasticizer is  
5 epoxidized methyl soyate; and  
6 (c) about 1-3 parts thermal stabilizer compounded with said at least  
7 one vinyl chloride resin and said plasticizer.

- 1 (27) A plasticized vinyl chloride composition, comprising:  
2 (a) about 100 parts by weight of at least one vinyl chloride resin;  
3 (b) about 10 to 100 parts by weight of a plasticizer compounded with  
4 said at least one vinyl chloride resin, wherein said plasticizer is  
5 epoxidized sucrose octasoyate; and  
6 (c) about 1-3 parts thermal stabilizer.

- 1 (28) A plasticized vinyl chloride composition, comprising  
2 (a) about 100 parts by weight of at least one vinyl chloride resin; and  
3 (b) about 10 to 100 parts by weight of a plasticizer compounded with  
4 said at least one vinyl chloride resin, wherein said plasticizer is the  
5 epoxidized product of a first ester interesterified with a second  
6 ester; and  
7 (c) about 1-3 parts thermal stabilizer compounded with said at least  
8 one vinyl chloride resin and said plasticizer.



- 1 (29)A plasticized vinyl chloride composition, comprising  
2 (a) about 100 parts by weight of at least one vinyl chloride resin; and  
3 (b) about 10 to 100 parts by weight of a plasticizer compounded with  
4 said at least one vinyl chloride resin, wherein said plasticizer is the  
5 epoxidized product of a first vegetable oil interesterified with a  
6 second vegetable oil; and  
7 (c) about 1-3 parts thermal stabilizer compounded with said at least  
8 one vinyl chloride resin and said plasticizer.

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1 (30) The composition of claim 28, wherein said first vegetable oil is soybean  
2 oil, and said second vegetable oil is linseed oil.  
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